

## New Record of the Genus *Muscaphis* (Sternorhyncha, Aphididae) in the Eastern Palearctic Region

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**Abstract** *Muscaphis stroyani* (Smith, 1980) and *Muscaphis escherichi* (Börner, 1939) were collected from Mt. Baekdu-san, North Korea. Fundatrix and alate emmigrant female of the Korean specimens are described. Host plants and brief biology of each species are discussed and the biometric data for fundatrix and alate emmigrant female are given. A key to species for fundatrix and alate emmigrant female is also presented.

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**Key words** Sternorhyncha, Aphididae, *Muscaphis stroyani*, *Muscaphis escherichi*, Korea

### INTRODUCTION

Since the genus *Muscaphis* Börner, 1933 was described with *Muscaphis musci* Börner, 1933 as a type species, eight species and two subspecies have been described in the world; *M. canadensis* (Hille Ris Lambers, 1960) (*Toxopterella*), *M. smithi* (Hille Ris Lambers, 1962) (*Toxopterella*), *M. stroyani* (Smith, 1980) (*Toxopterella*), *M. utahensis* (Smith & Knowlton, 1965) and *M. escherichi drepanosiphoides* (MacGillivray & Bradley, 1961) (*Toxopterella* (*Sorbobium*)) from North America; *M. mexicana* Remaudière & Munoz Viveros, 1985 from Mexico; *M. cuspidata* (Stroyan, 1955) (*Aspidaphium*), *M. escherichi* (Börner, 1939), *M. escherichi irae* (Shaposhnikov, 1963) (*Toxopterella* (*Sorbobium*)), and *M. musci* Börner, 1933 from Europe. However, this genus has not been reported from the Eastern Palearctic Region up to now.

*Muscaphis* is closely related to the genus *Myzus*, but it can be separated by the whole surface of fundatrix very scabrous and hind tibiae armored by peg-like setae as like *Toxoptera*. Recently, it has been revealed that species of this genus migrate from the primary host (*Crataegus*, *Sorbus*, *Pyrus* etc) to various mosses as the secondary summer hosts (Remaudière & Munoz Viveros, 1985; Stekolshchikov & Shaposhnikov, 1993).

*M. stroyani* (Smith, 1980) and *M. escherichi* (Börner, 1939) are recognized from the North Korean

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specimens, which are preserved in the Institute of Entomology, Czech Academy of Sciences (IE CAS), České Budějovice, Czech Republic. Fundatrix and alate emmigrant female are described for Korean specimens here.

Abbreviations used for descriptions in this paper are as follows: Ant. I, II, III, IV, V, VIb, antennal segment I, II, III, IV, V, and the base of Ant. VI, respectively; PT, processus terminalis; URS, ultimate rostral segment; 2HT, second segment of hind tarsus; SIPH, siphunculus.

Host plant names are cited from 'The Plant Names Project (1999). International Plant Names Index. Published on the Internet; <http://www.ipni.org> [accessed 10 September 2001]'.

All specimens examined in this paper are housed in the Institute of Entomology, Czech Academy of Sciences (IE CAS), České Budějovice, Czech Republic and the National Institute of Agricultural Science and Technology (NIAT), Suwon, Korea.

This is a part of the results of the Cooperative Research Project, "Aphids, their parasitoids and the biological control of aphids on the Korean Peninsula" between IE CAS, České Budějovice, Czech Republic and NIAT, Rural Development Administration (RDA) of the Republic of Korea.

## SYSTEMATICS

### *Muscaphis* Börner, 1933 이끼진딧물속 (신칭)

*Muscaphis* Börner, 1933: 4 (type species: *Muscaphis musci* Börner, 1933).

*Aspidaphium* Börner, 1939 (syn. by Stekolshtshikov & Shaposhnikov, 1993).

*Toxopterella* Hille Ris Lambers, 1960 (syn. by Remaudière & Munoz Viveros, 1985).

*Toxopterella* subgen. *Sorbobium* MacGillivray & Bradley, 1961. (syn. by Remaudière & Munoz Viveros, 1985)

### Key to the species of *Muscaphis* in Korean Peninsula

#### **Fundatrix**

1. Body small, 2.50–2.79 mm long. SIPH short, 0.31–0.39 mm long. URS 1.14–1.25x as long as 2HT, 0.671–0.833x as long as the base of Ant. VI (Ant. VIb). Cauda with ca. 6 hairs. Antennae pale brown. Primary host: *Crataegus* spp. (Rosaceae). Secondary host unknown, probably on moss. North America (North Carolina), Korea (North) ..... *M. stroyani* (Smith)
- Body large, 4.10–4.35 mm long. SIPH 0.67–0.73 mm long. URS 1.42–1.55x as long as 2HT, 0.500–0.548x as long as Ant. VIb. Cauda hairy, bearing 28–40 hairs. Antennae dark brown or black. Primary host: *Sorbus* spp. (Rosaceae). Secondary host; mosses, so far known on *Plagiothecium lactum* (after Stekolshtshikov & Shaposhnikov, 1993). Canada, Europe (Finland, Sweden, and Czech), Russia, Korea (North) ..... *M. escherichi* (Börner)

#### **Alate viviparous emmigrant**

1. Body small, 1.52–1.74 mm long. SIPH cylindrical, imbricated, 0.13–0.15 mm long, and 2.00–2.90x as long as cauda. Ant. III–Ant. V with 24–29, 13–19, and 9–14 secondary rhinaria respectively. Cauda with 5–6 hairs ..... *M. stroyani* (Smith)

- Body relatively large, 2.01–2.74 mm long. SIPH somewhat bottle-shaped, distinctly swollen on basal 2/3, 0.46–0.56 mm long, 4.2–6.0x as long as cauda, surface smooth or weakly spinulated. Ant. III–Ant. V with 31–42, 21–35, and 15–25 secondary rhinaria respectively. Cauda with 11–15 hairs. ....  
.....*M. escherichi* (Börner)

***Muscaphis escherichi* (Börner, 1939) 이끼진딧물 (신칭)**

(Fig. 1, Table 1)

*Aspidaphium escherichi* Börner, 1939.

*Muscaphis jeschkei* Börner, 1939.

*Toxopterella* (Sorbobium) *drepanosiphoides* MacGillivray & Bradley, 1961: 1000.

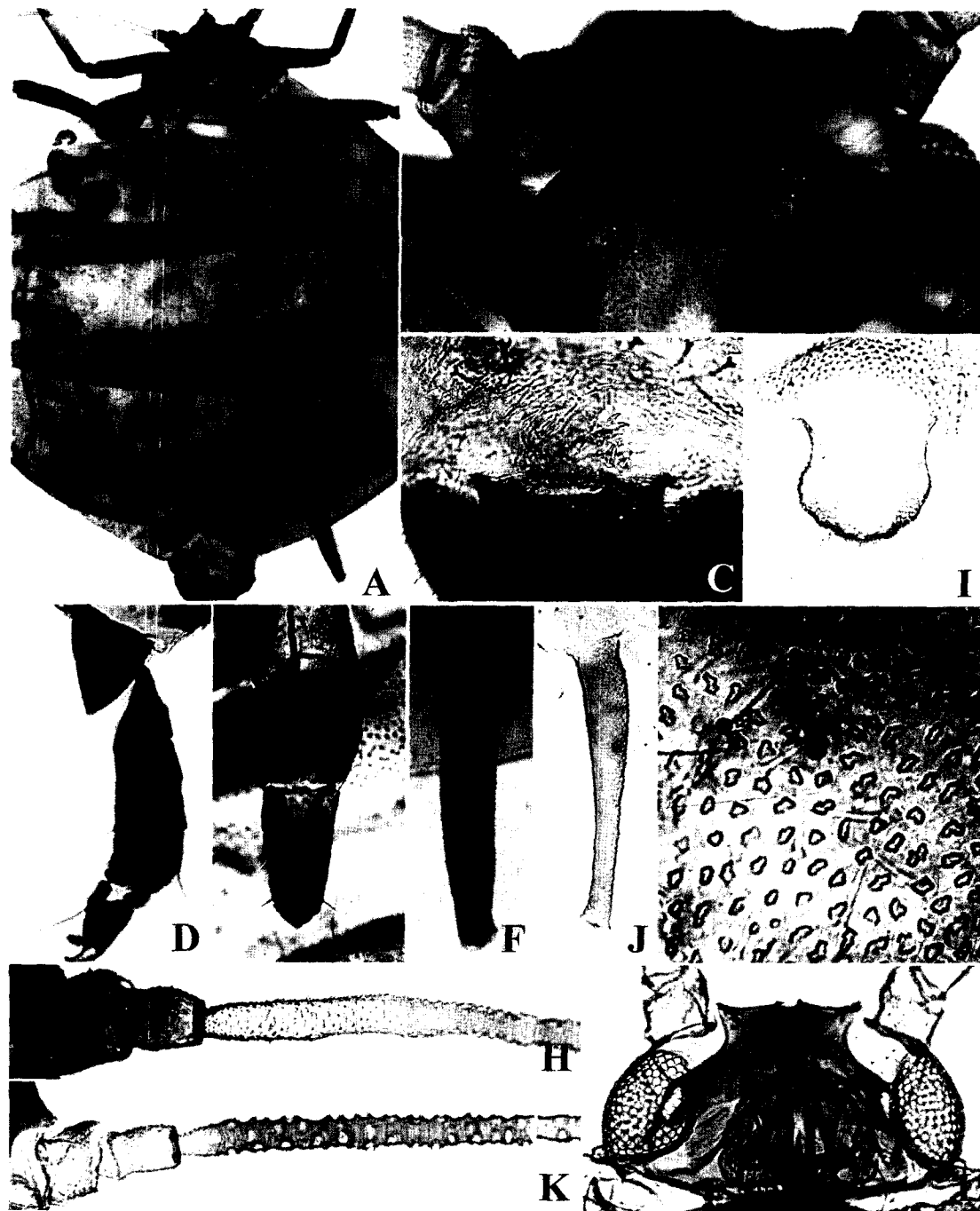
*Muscaphis drepanosiphoides*: Remaudière & Munoz Viveros, 1985: 436.

*Muscaphis escherichi*: Stekolshchikov & Shaposhnikov, 1993: 334.

*Fundatrix*. Colour (in macerated specimens): Head dark brown or black. Thorax and abdomen pale brown. Antennae pale brown. Legs brown to pale brown with hind femur rather dark. Siphunculus, cauda, and anal plate dark brown or black.

Morphology: Body round oval, 4.10–4.35 mm long, scabrous with dense wart-like nodules all over the body. Head: densely and strongly scabrous on dorsum and ventrum with numerous acute short hairs (ca. 40) dorsally, the longest as long as or slightly longer than the basal width of Ant. III. Antennal tubercle undeveloped. Antennae short, 0.47–0.51x as long as body length; scabrous on Ant. III–Ant. IV; strongly imbricated on Ant. V–Ant. VI; antennal chaetotaxy ca. 11, 5, 3, and 2+1 on Ant. III–Ant. VIb+PT respectively; the longest hair on Ant. III as long as or slightly longer than the basal width of Ant. III; Ant. III and Ant. IV fused frequently; primary rhinarium on Ant. V small, the longest diameter shorter than 1/2x middle width of the segment; PT short, 1.03–1.19x as long as the base of Ant. VI. Rostrum short, rarely attaining the mesocoxae; clypeus with 6–8 hairs and mandibular laminae 6–7 hairs on each side; URS wedge shaped with 2–4 secondary hairs, 1.41–1.55x as long as the 2HT, 0.50–0.55x as long as the base of Ant. VI. Thorax: denticulated all over with numerous hairs ventrally and dorsally. Legs denticulated with numerous hairs, the longest hair on femora shorter (0.5–0.7x) than the basal width of segment; hind tibiae with a row of ca. 12–15 peg like setae; first tarsal chaetotaxy: 3 : 3 : 3. Abdomen: covered with small wart-like ornamentations and numerous hairs. Siphunculi cylindrical, strongly spinulated, widest at basal 1/4, weakly tapering to apex, 4.19–4.56x as long as cauda. Cauda helmet-shaped with 28–40 hairs.

*Alate emmigrant female*. Colour (in macerated specimens): Head and thorax dark brown. Abdomen pale. Antennae, legs, SIPH, and cauda pale brown. Wings transparent with fuscous pigmentation along veins. Morphology: body 2.01–2.74 mm long. Head: smooth with one pair of short dorsal hairs; numerous short hairs on vertex and ventrally; antennal tubercle undeveloped. Antennae 0.931–1.204x as long as body length; Ant. I–II weakly spinulated with 4–7 and 3–7 hairs respectively; Ant. III–V weakly imbricated covered with 31–42, 21–35, and 15–25 secondary rhinaria respectively; primary rhinarium on Ant. V as large as the secondary rhinaria or slightly larger; Ant. VI imbricated; PT long 2.70–3.80x as long as the base of Ant. VI. Rostrum attaining in the middle between procoxae and



**Fig. 1.** Fundatrix and alate emigrant viviparous female of *Muscaphis escherichi* (Börner, 1939). A-H (fundatrix): A. fundatrix on *Sorbus amurensis*; B. head (dorsal); C. cauda; D. hind tarsus; E. third and ultimate rostral segment (URS); F. siphunculus; G. wart-like ornamentation on abdominal tergum; H. antennal segments I-III. I-L (alate emigrant viviparous female): I. cauda; J. siphunculus; K. antennal segments I-III; L. head (dorsal).

**Table 1.** Biometric data of *Muscaphis escherichi* (Börner, 1939)

Part		Fundatrix (n = 14)			Alate emmigrant female (n = 32)		
		Min	Max.	Avr.	Min.	Max.	Avr.
Length of (in mm)	body from antennal tubercle to cauda (L)	4.10	4.35	4.22	2.01	2.74	2.44
	whole antennae (A)	1.94	2.15	2.10	2.28	2.63	2.41
	antennal segment III (Ant. III)	0.42	0.46	0.44	0.42	0.49	0.45
	antennal segment IV (Ant. IV)	0.40	0.46	0.43	0.33	0.40	0.36
	antennal segment V (Ant. V)	0.34	0.43	0.40	0.37	0.47	0.42
	the base of antennal segment VI (Ant. VIb)	0.31	0.35	0.33	0.18	0.27	0.23
	processus terminalis (PT)	0.36	0.39	0.37	0.66	0.88	0.78
	ultimate rostral segment (URS)	0.17	0.18	0.173	0.11	0.14	0.121
	hind tibiae	1.31	1.37	1.33	1.34	1.56	1.45
	hind femur	0.84	0.89	0.86	0.67	0.81	0.72
	hind tarsus II (2HT)	0.11	0.13	0.118	0.093	0.114	0.100
	siphunculus (SIPH)	0.67	0.73	0.70	0.46	0.56	0.50
	cauda	0.16	0.16	0.160	0.093	0.114	0.102
No. of hairs on	Ant. I	4	5	4.8	4	7	5.2
	URS	2	4	3.0	3	7	4.4
	abdominal tergite III	—	—	—	16	30	24.9
	ab. tergite VI between SIPH	—	—	—	2	5	3.1
	ab. tergite VIII	—	—	—	2	2	2.0
	cauda	28	40	36.0	11	15	12.7
No. of rhinaria on	Ant. III	0	0	0	31	42	37.9
	Ant. IV	0	0	0	21	35	28.3
	Ant. V	0	0	0	15	25	19.0
Ratio	URS/2HT	1.417	1.545	1.471	1.088	1.333	1.209
	URS/Ant. VIb	0.500	0.548	0.523	0.422	0.633	0.521
	PT/Ant. VIb	1.029	1.194	1.122	2.731	3.800	3.338
	SIPH/Cauda	4.188	4.563	4.396	4.211	6.022	4.970
	SIPH/Ant. III	1.457	1.738	1.590	0.980	1.256	1.122
	SIPH/Hind femur	0.798	0.869	0.823	0.630	0.771	0.700
	A/L	0.473	0.512	0.498	0.896	1.204	1.000

mesocoxae; clypeus 2 short hairs and mandibular laminae with 4–7 hairs on each side; URS wedge-shaped with 2–4 secondary hairs. Thorax: smooth with 1 pair of short mesial hairs on pronotum; hind coxae weakly spinulated with ca. 10 hairs; trochanter smooth with 3 hairs; hind femur and tibia weakly spinulated with short hairs, the longest hairs 1/2x as long as the basal width of femur. Abdomen: membranous with 16–30, 2–5, and 2 hairs on tergite III, VI between siphunculi, and VIII respectively. Siphunculi smooth or very weakly spinulated, bottle shaped, wide from base to apical 2/3, then abruptly tapering to apex, bearing with rarely 1–4 short hairs. Cauda round, jar-shaped with 11–15 hairs. Genital plate hairy.

*Specimens examined.* 22 alate viviparous emmigrant females, Mt. Baekdu-san, Samjiyon, North Korea, 10.vii.1985, No. 85HA1511, on *Sorbus sambucifolia* M. Roem; 5 fundatrices, Mt. Baekdu-san, Samjiyon, North Korea, 25.vi.1988, No. 88HA3163, on *Sorbus amurensis* Koehne.

*Distribution.* Canada, Europe (Finland, Sweden, and Czech), Russia, Korea (North).

*Host plant.* Primary host: *Sorbus* spp. (*sambucifolia*, *amurensis* in Korea). Secondary summer host: *Plagiothecium lactum* (after Stekolshchikov & Shaposhnikov, 1993).

*Note.* Stekolshchikov & Shaposhnikov (1993) transferred the emmigrant of *Muscaphis escherichi* successfully on *Plagiothecium lactum* and described all stages. Comparing with their specimens, Korean sepcimens differs as follows: fundatrix large, 4.10–4.43 mm (2.73–3.79 mm in Stekolshchikov & Shaposhnikov, 1993), bearing 28–40 hairs on cauda (21–28 in Stekolshchikov & Shaposhnikov, 1993). According to Shaposhnikov (1963), the second media-fork are absent in majority of alate and prescense of hairs on siphunculi, but Filand population same to North American population. Most Korean samples have the second media-fork and few of them with 1–2 hairs on SIPH.

***Muscaphis stroyani* (Smith, 1962) 산사이끼진딧물 (신칭)**

(Fig. 2, Table 2)

*Toxopterella stroyani* Smith, 1980: 277.

*Muscaphis stroyani*: Remaudière & Munoz Viveros, 1985: 436.

*Fundatrix.* Colour (in macerated specimens): head including antennae dark brown or black. Prothorax dark brown; meso- and metathorax and abdomen pale or pale brown. Legs, SIPH, cauda, and genital plate dark brown.

*Morphology:* Body oval, 2.50–2.79 mm long, covered by strong wart-like ornamentation throughout the body. Head: densely scabrous with 3–5 pairs of dorsal hairs. Antennal tubercle undeveloped, or very weakly developed. Antennae short, 0.43–0.51x as long as body length; Ant. I–Ant. II scabrous or granulated with 3–4 hairs; Ant. III–Ant. VI imbricated with ca. 5, 3, and 2+2 on Ant. III, IV and Ant. VI+PT respectively; primary rhinarium on Ant. VI small, the longest diameter 1/2x as long as the middle width of the segment; PT short 1.128–1.676x as long as the base of Ant. VI; the longest hair on Ant. III, as long as or slightly shorter than the basal width of the segment. Rostrum short, attaining in the middle between procoxae and mesocoxae; clypeus with 2 hairs and mandibular laminae with 3–4 hairs on each side; URS with 2 secondary hairs, 1.136–1.125x as long as 2HT, 0.671–0.833x as long as the base of Ant. VI. Thorax: strongly granulated with wart-like ornamentations, 4–5 spinal hairs and 1–2 marginal hairs anteriorly; 2 pairs of elevated plates on pronotum anterior-marginally and porterior-mesially. Hind coxae weakly spinulated with ca. 10 hairs; trochanter smooth with 3–4 hairs; femora spinulated or scabrous with many hairs, the longest hairs as long as or slightly shorter than the basal width of the segment; tibiae smooth or very weakly spinulated with a row of 8–10 peg-like setae; first tarsal chaetotaxy : 2 : 2 : 2; 2HT with 4–5 hairs. Abdomen: scabrous with dense wart-like ornamentations, hairy, the longest hair as long as the basal width of hind femur; tergite VIII with 2–5 hairs. Siphunculi strongly scabrous, 4.167–4.760x as long as cauda. Cauda helmet-shaped, bearing 14–17 hairs. Genital plate hairy.

*Alate viviparous emmigrant female.* Colour (in macerated specimens): head and thorax dark brown. Abdomen pale with dark marginal sclerites on tergite II–V and genital plate. Antennae, legs, SIPH, and cauda pale brown.

*Morphology:* Body small, 1.52–1.74 mm long. Head: smooth dorsally with 3 pairs of hairs; antennal



**Fig. 2.** Fundatrix and alate emigrant viviparous female of *Muscaphis stroyani* (Smith, 1980). A-I (fundatrix): A. fundatrix on *Crataegus pinnatifida*; B. head (dorsal); C. cauda; D. hind tarsus; E. third and ultimate rostral segment (URS); F. siphunculus; G. wart-like ornamentation on abdominal tergum; H. hind tibia; I. antennal segments (I-IV). J-M (alate emigrant viviparous female): J. cauda; K. siphunculus; L. antennal segments I-III; M. head (dorsal).

**Table 2.** Biometric data of *Muscaphis stroyani* (Smith, 1980)

Part		Fundatrix (n=6)			Alate emmigrant female (n=18)		
		Min	Max.	Avr.	Min.	Max.	Avr.
Length of (in mm)	body from antennal tubercle to cauda (L)	2.50	2.79	2.59	1.52	1.74	1.62
	whole antennae (A)	1.07	1.28	1.18	1.37	1.67	1.51
	antennal segment III (Ant. III)	0.35	0.47	0.41	0.31	0.36	0.33
	antennal segment IV (Ant. IV)	0.18	0.26	0.23			
	antennal segment V (Ant. V)	0.15	0.24	0.21	0.21	0.26	0.24
	the base of antennal segment VI (Ant. VIb)	0.16	0.20	0.18	0.14	0.19	0.16
	processus terminalis (PT)	0.20	0.28	0.24	0.37	0.50	0.44
	ultimate rostral segment (URS)	0.13	0.14	0.132	0.09	0.10	0.097
	hind tibiae	0.76	0.94	0.88	0.83	0.94	0.88
	hind femur	0.52	0.61	0.58	0.39	0.44	0.42
	hind tarsus II (2HT)	0.10	0.12	0.112	0.08	0.09	0.083
	siphunculus (SIPH)	0.31	0.39	0.36	0.13	0.15	0.14
	cauda	0.081	0.086	0.084	0.052	0.071	0.060
No. of hairs on	Ant. I	3	3	3	3	4	3.2
	URS	2	2	2	2	2	2.0
	abdominal tergite III	—	—	—	18	25	21.6
	ab. tergite VI between SIPH	—	—	—	2	3	2.2
	ab. tergite VIII	5	5	5	3	5	4.0
	cauda	6	6	6	5	6	5.8
No. of rhinaria on	Ant. III	0	0	0	24	29	26.2
	Ant. IV	0	0	0	13	20	16.1
	Ant. V	0	0	0	9	14	10.8
Ratio	URS/2HT	1.136	1.250	1.182	1.067	1.293	1.180
	URS/Ant. VIb	0.671	0.833	0.750	0.505	0.708	0.599
	PT/Ant. VIb	1.128	1.676	1.378	2.229	3.172	2.694
	SIPH/Cauda	4.167	4.706	4.447	2.000	2.909	2.402
	SIPH/Ant. III	0.758	1.108	0.890	0.392	0.463	0.428
	SIPH/Hind femur	0.573	0.752	0.644	0.301	0.373	0.337
	A/L	0.430	0.511	0.458	0.844	1.000	0.928

tubercle undeveloped; frons with 4–5 hairs; weakly spinulated ventrally. Antennae long, 0.844–1.000x as long as body length; Ant. I–II scabrous with 3 hairs on each segment; Ant. III–V imbricated with 24–29, 13–20, and 9–14 secondary rhinaria respectively; primary rhinarium on Ant. V nude as large as secondary rhinaria; Ant. VI imbricated, PT 2.23–3.17x as long as the base of Ant. VI. Rostrum attaining in the middle between procoxae and mesocoxae; clypeus with 2 hairs and mandibular laminae with 2–3 hairs on each side; URS 1.07–1.29x as long as 2HT. Thorax: pronotum with 2–3 spinal hairs and 2 marginal hairs on each side, located close to anterior margin. Hindcoxae spinulated with 8 setae; trochanter smooth with 3 hairs; hind femora spinulated and hairy; the longest hair 1/2x as long as the basal width of hind femur; tibiae smooth; first tarsal chaetotaxy 3 : 3 : 3; 2HT imbricated with 3–4 hairs apically. Abdomen: abdominal dorsum membranous, weakly spinulated; tergite III with 18–25 setae, the longest one 1/2x as long as the basal width of the hind femur; 2–4 hairs on tergite VI between siphunculi; 3–5 hairs on tergite VIII. Siphunculi spinulated 2.00–2.90x as long as cauda. Cauda



spinulated, helmet-shaped with 5–6 hairs. Genital plate hairy.

*Specimens examined.* 7 fundatrices and 71 alate viviparous females, Mt. Baekdu-san, Samjiyon, North Korea, 16.vii.1987, No. 87HA2297, 87HA2336, 87HA2337, 87HA2338, 87HA2339, 87HA2349, 87HA2350, 87HA2351, on *Crataegus pinnatifida* Bunge; 9 fundatrices, Mt. Baekdu-san, Samjiyon, North Korea, 16.vi.1988, 88HA3040, 88HA3101, on *Crataegus maximowiczii* Rouy & Camus; 6 fundatrices, Mt. Baekdu-san, Samjiyon, North Korea, 25.vi.1987, 88HA3178, on *C. maximowiczii*.

*Biology & Host plants.* Probably migrates from *Crataegus* spp. (*pinnatifida*, *maximowiczii* in Korea) to mosses as the secondary summer host. However, it has not been recorded on moss yet.

*Distribution.* North America (North Carolina), Korean (North).

## ACKNOWLEDGMENTS

The authors are indebted to Dr. Jaroslav Holman, the Institute of Entomology, Czech Academy of Sciences, České Budějovice, Czech Republic for his kind advices and guidance in the study of Korean aphids. The authors also thank Dr. Robert Footitt, Agriculture and Agri-Food Canada, Ottawa, Ontario for the loan of materials.

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(Received: August 13, 2001)

(Accepted: October 16, 2001)